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Digital imaging of atomization processes in electrothermal atomizers for atomic absorption spectrometry

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Abstract

A charge-coupled device (CCD) camera was used as the detector in an Imaging system that was constructed for the Investigation of atomizers for atomic absorption spectrometry. The two-dimensional distributions of aluminum atoms and aluminum-containing molecules in an electrothermal atomizer were measured as a function of time. The temporally- and spatially-resolved distributions in the electrothermal atomizer were measured for atomization from both the graphite tube wall and a graphite platform. The main features of the measured two-dimensional distributions of aluminum atoms ere a pronounced decrease in the number density near the sample dosing hole with the highest number density being adjacent to the graphite tube walls. The main features of the measured two-dimensional distributions of aluminum-containing molecules are a decrease in the number density adjacent to the graphite tube walls with the highest number density being along the central axis of the graphite tube. The measured distributions of aluminum atoms and aluminum-containing molecules in the electrothermal atomizer are consistent with an atomization mechaniam that consists of the following three reactions: (1) thermal dissociation of solid aluminum oxide that yields both gaseous aluminum atoms and gaseous aluminum aub-oxides, (2) homogeneous oxidation of aluminum atoms by gaseous oxygen molecules that yields gaseous aluminum sub-oxides, and (3) heterogeneous reduction of gaseous aluminum sub-oxides at the graphite surface that yields gaseous aluminum atoms.